MATH ON TRIAL – EXAM

MARCELLO DI BELLO – DUE BY JUNE 7TH, 2015 VIA EMAIL

Write 2-3 pages answering 2-3 of the items below. Your answers should be crisply written, wonderfully clear, and elegantly argued. They should demonstrate original and independent thinking. **Feel free to disagree with me. Always motivate your claims. Do not quote verbatim from the readings, but use your own words.**

1. Describe the different interpretations of probability we discussed (classical, subjective, and frequency-based). For example, what do Laplace, de Finetti and von Mises say on the topic? Which interpretation is best suited for the trial context? Motivate your answer.

2. In DNA evidence cases, we say that a genetic profile has an "estimated frequency" of $1/n$ or that the probability that a random person would have the profile is $1/n$. What do we mean by that? Which interpretation of probability best applies to $1/n$? Motivate your answer.

3. Illustrate the inversion fallacy. Why is it also called prosecutor's fallacy? Was this fallacy committed in Collins? In Rush? In the Lucia de Berk case? Explain. Find examples of the inversion fallacy in the news, in other legal cases or in non-legal scenarios.

4. State and prove Bayes' theorem, both the standard version and the "odds formulation". Apply Bayes' theorem to (a) the Collins case; (b) the Rush case; and (c) the "Island Problem" (or Lucia de Berk). Illustrate how the "prior odds" affect the "posterior odds".

5. Describe the "uniqueness approach" in the mathematical appendix of the Collins decision. Compare this approach with Bayes' theorem. Which is better? Discuss footnote 12 of the Finkelstein & Fairley article. Do you agree or not? Explain.

6. Discuss the Rush decision, and in particular the claims that (a) DNA evidence alone (given certain restrictions) is enough for a conviction in a rape case; (b) that if fingerprints alone are enough for a conviction, then DNA evidence must be enough as well; and (c) that DNA evidence is less prone to error than eyewitness evidence. Do you agree or not? Motivate your answer.

7. Describe the cold-hit controversy as well as the three proposals on the table: NRC; likelihood ratio; and Bayes' theorem. Which one do you think it's better? Motivate your answer. You may also weigh the pros and cons of each approach without siding with one proposal in particular.

8. How did the expert witness in the Lucia de Berk case arrive at the value 1 in 342 million? What formula(s) did he use? Did he make questionable assumptions? If so, what are they? Is there a way to fix his calculations? Would the use of Bayes' theorem help us here? Motivate your answer.